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WHY DON'T POOR COUNTRIES CATCH UP? A CROSS-NATIONAL TEST OF AN INSTITUTIONAL EXPLANATION

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Early neoclassical analyses predicted that poor countries would grow faster than wealthy countries, because of technological advances and diminishing returns to capital in the latter. The reverse has occurred: poor countries are falling back rather than catching up. We suggest here that deficient institutions underlie this divergence. Employing various indicators of institutional quality, including the rule of law, the pervasiveness of corruption, and the risk of expropriation and contract repudiation, we show that the ability of poor countries to catch up is determined in large part by the institutional environment in which economic activity in these countries takes place. (*JEL* O00, O10)

Since 1952 scholars have advanced the hypothesis that poorer countries should grow faster than richer ones. Some have derived this hypothesis from the assumption of diminishing returns to physical capital, which should cause more advanced countries to grow more slowly than less advanced countries, as in Barro and Sala-i-Martin [1995]. Others have focused not on the disadvantages of being relatively advanced, but on the advantages of "relative backwardness." Gerschenkron [1952] articulated the basis for this work, arguing that the cost of industrialization could be lower and the speed of industrialization faster in undeveloped countries than it had been for the industrialized nations because the former could take advantage of the technological advances of the latter.

However, the persistence, and even growth, of the gap between the world's rich and poor nations seems to contradict this hypothesis. Although Baumol [1986] found convergence among a sample of OECD countries, DeLong [1988] demonstrated that incomes failed to converge between 1870 and 1979 among a set of countries that were the richest in the world at the beginning rather than at the end of the sample period. Other research, though, has found evidence for convergence conditional on the presence of such impediments to growth as low factor accumulation, insufficient levels of investment in human capital, barriers to foreign trade and investment, and, related to several of these, low equipment and machinery investment. When factors such as these are controlled for, there is some evidence that poor countries grow faster than rich countries.[1]

We focus on another potential obstacle to convergence: an inadequate legal, political and regulatory framework—the "institutional environment." Deficiencies in the institutional environment may reduce investment and the ability of countries to absorb technological advances from abroad. Without these advances, countries may grow more slowly. The analysis below employs various indicators of institutional quality, including measures of the prevalence of the rule of law, the pervasiveness of corruption, and the risk of expropriation and contract repudiation to investigate the hypothesis that the ability of poor countries to catch up is at least partially determined by the institutional environment in which economic activity in these countries takes place.

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1. See, for example, Levine and Renelt [1992] and DeLong and Summers [1991].

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Our regressions use an interaction specification to test whether countries with institutions that support stable and secure contractual and property rights are more likely to "catch up" than are countries lacking these institutions. Our results indicate that when good institutions are absent, convergence slows. In extreme cases, poor countries with institutions that are excessively deficient are found to grow more slowly than wealthy countries, even when other factors, including investments in human and physical capital, are taken into account. This manifestation of the "poor getting poorer" appears to be a direct consequence of the institutional environment in those countries.

Our investigation of the effect of institutions on convergence differs from other analyses in at least two ways. First, we explicitly set out multiple paths through which institutions might affect the rate of convergence. Second, we use measures of the institutional environment that capture those dimensions that are most likely to influence investor behavior, particularly the security of property and contractual rights.

I. INSTITUTIONS AND "CATCH-UP"

Inadequate institutions degrade the security of property rights, broadly defined as the rights of a firm or individual to assets, to the revenue streams generated by assets, and to any other contractual obligations due the firm or individual. These rights are more secure to the extent that political and legal institutions inhibit unilateral private or public decisions that dramatically or frequently reassign them. Institutions that have this effect include independent judiciaries and a division of executive and legislative powers that provides checks and balances, well-defined administrative procedures, and transparent decision making. These institutions also inhibit governments from making dramatic or frequent policy changes, as Weingast [1993] and Keefer [1994] argue.[2]

When property rights or the policy environment are not credible, firms are likely to make less efficient adjustments to changes in technology or to government policies. More secure property rights and credible policy regimes increase the incentives of entrepreneurs to adopt those techniques that maximize long-run profits. Firms make less efficient adjustments and continue to use obsolescent technology if those policies are not credible, or if optimal firm adjustments leave them more vulnerable to expropriation.[3] This creates a static loss, but also has dynamic effects. If subsequent growth is conditioned by current production choices, which is likely if learning by doing is an important component of productivity increases, the lack of credibility of the policy environment reduces growth.

Implications for convergence are clear. One theory of "catch up" depends on the existence of greater returns to capital in poorer countries. In this case, uncertainty about property rights delays convergence simply by deterring investment, preventing these countries from taking advantage of the greater returns. Alternatively, convergence depends on countries taking advantage at low cost of the technical discoveries made in richer countries. This typically requires countries to acquire new technologies, such as advanced telecommunications equipment, that are often embodied in expensive or highly specific capital assets. The introduction of such technologies therefore requires dependable long-term economic relationships and reliable guarantees of property rights.

Poor institutions that do not guarantee property rights can also interfere with growth by promoting entrepreneurs who are less able to take advantage of new technologies. Where institutions are inadequate, entrepreneurs succeed on the basis of political rather than economic criteria: inefficient entrepreneurs survive who happen to have the personal ties with state officials that are necessary to protect against expropriation (see Keefer [1994]). If technological progress in an industry is lim-

2. Even if the entrepreneur's expectation is that, on average, the policies of today will prevail tomorrow, the possibility of large deviations from today's policies—which is higher when institutions are deficient—is sufficient to induce slower investment and less efficient production.

3. This conclusion is related to Le Chatelier's Principle: the lack of credibility compels firms to treat the policy environment as a constraint to which they can only make short-run adjustments; as a consequence, firms do not make changes in their production processes that move them along their lower-cost, long-term production function.

ited by the ability of the most able entrepreneurs in the industry, then growth suffers when noneconomic characteristics determine which entrepreneurs survive.[4]

II. MEASURING INSTITUTIONAL QUALITY

Ideally, measures of institutional quality would consist of objective evaluations, comparable across countries and over time, of the institutions that protect property and contractual rights. Indicators of the security of property and contractual rights, the "output" of these institutions, would have the same characteristics. They would measure the risk in a country that contractual obligations are subject to default or that fixed assets are subject to expropriation of one form or another.

Ideal measures such as these do not yet exist because of the difficulties inherent in formulating and collecting them. For example, the relative contribution of different institutions to the protection of property and contractual rights is not yet well understood. Singapore, the United States and France all seem to pose little risk, relative to most countries, of expropriation or contract default, yet they achieve this result with markedly different institutional structures. The independence of the judiciaries in these countries varies considerably, as do electoral and legislative constraints on the executive branch and the nature of hiring and promotion processes in administrative agencies. It is not yet clear how these various institutional traits ought to be weighed in designing an objective measure of institutional quality.

A second difficulty with measuring institutional quality is that unobservable country traits, such as levels of "rule obedience" in a society, a concept introduced by Clague [1993], affect the risks of contract default or asset expropriation. Countries that have high levels of rule obedience are likely to require fewer institutions to restrain arbitrary expropriation by government officials. These unobservable traits are likely to vary across countries, creating biases in measures of observed institutional quality.

In the absence of more exact measures, two variables have been most commonly used to capture the effect of property rights on growth. Barro [1991], Barro and Sala-i-Martin [1995], DeLong and Summers [1991] and Benhabib and Spiegel [1994] use measures of violent regime change (revolutions and coups) and political assassinations as partial determinants of a country's steady-state level of income.[5] Various researchers have also employed the Gastil [1987] indices of political rights and civil liberties as an indicator of the security or quality of property rights.[6]

Each of these has significant drawbacks. For example, political instability directly measures neither the quality of the institutions that protect property rights nor the security of property and contractual rights. In addition, the phenomenon of insecure property rights extends far beyond the set of politically unstable countries. For their part, the Gastil indices have the disadvantage that they aggregate evaluations of countries made across many diverse dimensions into single scores, so the extent to which they capture institutional quality or the security of property rights is unclear.

We employ several measures, from three different sources, of institutional quality and the security of property and contractual rights. Two independent international investor risk services, International Country Risk Guide and Business Environmental Risk Intelligence,[7] separately evaluate such dimensions of institutional quality as bureaucratic quality and corruption. They also evaluate the quality of institutional outputs that bear on the security of property rights such as the rule of law, the risk of expropriation, and contract en-

4. Murphy, Shleifer and Vishny [1991] model the effects of rent-seeking in a world in which rates of growth fall because the most able entrepreneurs turn to rent-seeking rather than productive activity. The argument above suggests an alternative perspective: that the most successful entrepreneurs may not be able to engage in the most valued activity if they cannot rely on commitments from state officials regarding the security of their property rights.

5. If all countries exhibit the same underlying rate of convergence, then when a country's steady-state income is higher, for any given level of initial income, its growth should be faster.

6. E.g., Kormendi and Meguire [1985] and Scully [1992]. The Gastil indices are also used more broadly as democracy indicators.

7. These will henceforth be abbreviated for convenience as "Country Risk" and "Business Risk" respectively, keeping in mind that both firms measure similar dimensions of institutional quality.

forceability.[8] Country Risk data is first available for 1982; Business Risk for 1972. The third measure was collected by political scientists; this is the first paper to use this measure to analyze growth and convergence. It evaluates the extent to which there are constraints on decision making by the executive branch, again a measure of institutional quality.

These measures, described in greater detail below, have several advantages over other data sets. The executive constraints variable provides the first explicit test of the impact of at least one institutional characteristic that we hypothesize should enhance the security of property rights. The Country Risk and Business Risk indicators identify more clearly than previous measures those institutional outputs that are connected to insecure property rights. Moreover, although they are subjective, their accuracy is subject to a market test, since the evaluations are sold to foreign investors.[9]

Measures of the Security of Property and Contractual Rights: Expropriation and Contract Enforceability

Several Country Risk and Business Risk variables directly relate to the security of contractual and property rights. Two of the Country Risk variables are *Risk of Expropriation* and *Risk of Repudiation of Contracts by Governments*. The first measures the risk of confiscation and forced nationalization of foreign enterprises. The second is a measure of the risk that governments will repudiate or otherwise unilaterally change the terms of contracts with foreign businesses. Two roughly parallel indicators from Business Risk are the *Risk of Nationalization* and *Contract Enforceability*. As with the Country Risk variables, higher scores indicate a more favorable institutional environment (that is, a higher score for the "Risk of Nationalization" indicates lower risk). The expected sign in regressions of per capita growth rates on the Country Risk and Business Risk variables is thus positive.[10]

Measures of Institutional Quality: The Rule of Law and Constraints on the Executive

One way in which countries commonly secure property rights and avoid arbitrary changes in government policy is by constraining the decision-making powers of the executive branch of government. In OECD countries, the source of these constraints is often legislatures or an independent judiciary. Elsewhere the constraints may be internal to the workings of the ruling party. We use two measures of these constraints. One is the *Rule of Law*, a Country Risk variable. *Rule of Law* is scored higher when a country exhibits "sound political institutions, a strong court system, and provisions for an orderly succession of power." Lower scores indicate that "a tradition of depending on physical force or illegal means to settle claims" prevails and that upon changes in government new leaders "may be less likely to accept the obligations of the previous regime."

The second indicator of constraints on executive branch decision making is from the Polity II Dataset, labeled *Executive Constraints*.[11] This variable is scored low in countries where constitutional restrictions on executive action are ignored, the constitution is frequently revised at the executive's initiative, rule by decree is repeatedly used, and the executive appoints and removes at will the members of any group meant to oversee the executive (legislators and judges, for example). Countries receive a high score on executive constraints where the legislature initiates much important legislation, where the execu-

8. Knack and Keefer [1995] compare the impact on growth and investment of Country Risk and Business Risk variables to the impact of the Gastil and political instability variables. Mauro [1995] shows that investment and growth are correlated with subjective indexes of political instability and bureaucratic efficiency from Business International. Neither of those studies addresses convergence issues, as this one does. We do not use the Business International data as they lack both the broad country coverage that we gain from our Country Risk sample and the long time period the Business Risk sample offers.

9. The Business Risk and Country Risk variables could meet this market test, but still be subject to rater bias, leading each firm's variables to be highly correlated with each other. We indeed find a high intercorrelation [on the order of .8] among each firm's variables. This is not entirely surprising, since the underlying institutional conditions that give rise to high risks of government expropriation, for example, are also likely to create greater corruption. We separately discuss each of the variables that we employ, but also report empirical results using aggregated indices of each firm's variables.

10. The regressions reported below use the indicators as originally scaled, but the results are robust to alternative transformations, including the use of dichotomous variables formed from the original rankings. See also Knack and Keefer [1995] for further information on Country Risk and Business Risk variables.

11. Polity II compiled by Gurr et al. [1989].

tive is chosen by and is dependent on the legislature (as in most parliamentary systems) or where multiparty democracies and chronic cabinet instability prevail.[12]

Measures of Institutional Quality: Bureaucratic Quality

Arbitrary administrative decisions undermine the legal bases upon which the security of property and contractual rights in a country rests. Bureaucracies are more likely to act arbitrarily under two circumstances: when there are few institutional restrictions on them (for example, when there is no judicial oversight) and when the quality of the administrative officials is poor. The first needs no explanation. If public officials are of low professional caliber, greater error is introduced into administrative decisions, undermining the predictability of government decision making and therefore increasing the insecurity of property and contractual rights.[13]

Three subjective variables are used to measure the quality of government administration. Two of these are *Bureaucratic Quality* (from Country Risk) and *Bureaucratic Delays* (Business Risk). Countries score highest on these dimensions when the bureaucracy has the strength and expertise to govern without drastic changes in policy or interruption of governmental services. Such bureaucracies have established mechanisms for recruitment and training, and some autonomy from political pressure. A bureaucracy is therefore likely to score low when bureaucrats exercise substantial discretion in an arbitrary manner.

The third variable related to the effects of public administration on the security of property and contractual rights is *Corruption in Government* (from Country Risk). A country receives the lowest rating if high government officials are likely to demand special payments and if illegal payments are generally expected throughout lower levels of government. Corruption thrives when government decision making is opaque and there are few checks and balances built into the decision-making process. However, these same characteristics foster arbitrary decision making, with which corruption should therefore be associated.[14]

Because of the high correlations among the different dimensions of the Business Risk and Country Risk indicators, respectively, we use additive indices of the two sets of indicators. Intercorrelations among our institutional indicators are shown in Table I. Pair-wise correlations of these measures are fairly high, ranging from .65 for executive constraints and the Country Risk Index, to .83 for indexes of the Country Risk and Business Risk variables.[15] Since the two firms supplying the Country Risk and Business Risk variables purport to measure similar dimensions of institutional quality, the very high correlation between these two indexes provides some reassurance regarding their validity. Each of the institutional indicators is also highly correlated with income per capita.

III. SPECIFYING INSTITUTIONS IN A GROWTH FRAMEWORK

Most empirical models test convergence by examining whether initial per capita income

12. Cabinet instability suggests that gridlock might be a characteristic of countries with substantial executive restraints. If gridlock is a significant obstacle to growth, then the effect of executive constraints might be ambiguous since, naturally, single decision makers are less likely to experience gridlock than multiple decision makers. Our results suggest, however, that this negative effect is far outweighed by the positive influence of constraints on the executive. Indeed, controlling for per capita income we find that the average level of *Executive Constraints* from 1960–1986 is a large and highly significant determinant of the Business Risk and Country Risk indicators, a result that holds whether or not the sample includes OECD countries.

13. It might be argued that these two effects offset each other in the following sense. If regulations are excessively burdensome, economic outcomes may be more efficient if they are administered by an incompetent bureaucracy. However, the argument is at least as strong that an incompetent bureaucracy would worsen the effects of highly distortionary regulations.

14. Corruption may also have a positive effect, as a means to avoid inefficient regulation. The effectiveness of corruption in this regard depends on the efficiency of the "auction" through which corrupt government officials assign exemptions from onerous regulations. There is little evidence that these "auctions" result in the assignment of exemptions to the most efficient producers, particularly those producers who are not yet in the market. However, to the extent that this positive effect exists and is significant, the influence of corruption on growth is ambiguous.

15. We use simple additive indices of the three Business Risk and five Country Risk variables. We also experimented with indicators created through principal components and factor analysis of the two variable sets; these performed nearly identically. The six-point scales *Bureaucratic Quality, Corruption* and *Rule of Law* were transformed into ten-point scales for consistency with the two variables, *Risk of Expropriation* and *Repudiation*.

TABLE I
Correlations Among Institutional Indicators

Variable	Country Risk	Business Risk	Executive Constraints
GDP/Capita, 1960	0.71	0.73	0.62
Country Risk Index		0.83	0.65
Business Risk Index			0.66

has a negative effect on growth or, conversely, whether the gap between a country's per capita income and that of the country with the highest per capita income has a positive effect on growth (see, for example, Mankiw, Romer and Weil [1992] or Barro and Sala-i-Martin [1995]). A larger gap implies greater potential benefits from technological transfers, leading to faster growth, or from higher returns to capital. We use a different specification, one that allows the effects of the gap (and, therefore, of technological transfers) on subsequent growth to vary systematically with the adequacy of the institutional environment.

A typical empirical specification employed in this literature to examine rates of convergence is the following:[16]

$$(1) \quad Growth = \beta_0 + \beta_1 \ln y(0) + \beta_2(Human\ Capital) + \beta_3(Physical\ Capital) + \beta_4(Labor) + \beta_5(Political\ Instability) + \varepsilon.$$

The rate of convergence is derived from the estimated coefficient on $\ln y(0)$, the log of per capita income at time zero. We make two significant changes to this standard specification. First, we substitute institutional variables for political instability. Second, we allow for an additional term interacting institutional quality and initial income. There are at least two paths of institutional influence that would justify this alternative specification. First, the absence of secure property and contract rights reduces incentives to move factors to the sectors where technological progress increases rates of return. Second, inadequate institutions inhibit the adoption of new technologies that might improve factor productivity. That is, institutions affect the extent to which "relatively backward" countries can take advantage of advanced technologies from other countries at low cost. In order to test these paths of influence, institutions must be allowed to interact with the initial income gap between poorer countries and the richest country. A similar argument is used in Barro and Sala-i-Martin [1995] to justify the addition of a term interacting levels of human capital with initial income.[17]

Our basic specification is therefore the following:

$$(2) \quad y_i = \beta_0 + \beta_1(Primary\ Enrollment) + \beta_2(Secondary\ Enrollment) + \beta_3(Labor\ Force\ Growth) + \beta_4(Price\ Change) + \beta_5(Income\ Gap) + \beta_6(Institution) + \beta_7(Income\ Gap \times Institution) + \varepsilon$$

The average rate of per capita growth of countries from 1960 to 1989, y_i, is taken from

16. Many growth regressions (e.g., Barro [1991]) do not include investment because the exogenous variables that they investigate as determinants of growth operate on growth both directly and through investment. This is certainly true of the institutional variables considered here, which affect both the efficiency with which inputs are combined in the production process and the incentives of firms to invest. In any case, as we discuss below, our results on the growth effects of institutions are not affected substantially by the inclusion of investment.

17. Benhabib and Spiegel [1994] present a similar model that justifies interacting human capital with initial income, but their empirical specification does not include such a term.

Levine and Renelt [1992]. Primary and secondary education enrollments for 1960, as proportions of the relevant age groups, are commonly used proxies for investments in human capital (Barro [1991]). To control for labor inputs into production, we include *Labor Force Growth*, the change in the ratio of the labor force to the total population between 1960 and 1989. A similar variable is used by Blomstrom, Lipsey and Zejan [1992]. It is usually statistically significant, unlike population growth, the proxy for changes in the employment of labor used by Levine and Renelt [1992].[18] Also following Blomstrom, Lipsey and Zejan [1992], *Price Change* is employed, the ratio of 1960 income in 1985 prices to 1960 income in 1960 prices. This variable accounts for changes in national income due exclusively to changes in relative prices, preventing changes in the price of minerals such as petroleum from strongly influencing growth rates. This variable allows us to retain oil producers in our sample.[19]

A variety of options has been employed in the literature to specify the "catch-up" variable. A country's relative backwardness is operationalized here as the difference or gap between the log of 1960 GDP per capita of the richest country (the U.S.) and the log of 1960 per capita GDP for the particular country under examination.[20] Since the U.S. GDP variable is a constant, this amounts to a simple linear transformation of the standard specification.[21] If convergence is present, the sign on this "gap" variable should be positive.[22]

IV. THE INTERACTION OF INSTITUTIONS AND INCOME ON GROWTH

We examine the institutional interaction in several ways. First, we use individual Business Risk and Country Risk variables.[23] Because the intercorrelations among each firm's variables are very high, we also test the two Business Risk and Country Risk indexes. We also examine the influence of the executive constraints variable. Finally, we subject our results to a series of robustness tests. In all cases, the interaction terms equal the product of the deviations of the respective variables from their means.[24] The results reported below strongly suggest that the ability of developing countries to turn "relative backwardness" to their advantage depends on the protection that they offer property rights. If property rights protection in a particular country is sufficiently inadequate, a larger gap between the income per capita of that country and of the lead country in 1960 (the United States) actually reduces subsequent growth.

Table II reports the effects on convergence of the rule of law, one of the Country Risk variables (available for a sample of 97 countries), and of contract enforceability, a Business Risk variable (available for a sample of 47 countries). Models (1) and (3) follow the traditional specification described in equation (1) above. The income gap variable is significant, but the explanatory power of the models is relatively low, with adjusted R^2 values of .3 and .26. Models (2) and (4) present the interaction results. The interaction term is in

18. Benhabib and Spiegel [1992] utilize both labor force and population data and report obtaining similar results for each.

19. Levine and Renelt [1992], among others, simply delete the major oil exporters.

20. The log specification of the "catch-up" variable has a strong empirical underpinning, as well as theoretical justification. Using the log of per capita income has the appealing property of treating as (roughly) equivalent the gaps between Ghana ($863) and Guinea ($389) and the U.S. ($9776) and Italy ($4636), rather than weighting the latter gap much more highly than the former.

21. "Income gap" is thus equal to log (9,776) – log (1960 GDP per capita). DeLong [1988], Barro [1991] and Mankiw, Romer, and Weil [1992], among others, use log of initial GDP as a catch-up term in growth equations. The "gap" variation on this variable employed in regressions here differs trivially, merely reversing the sign on the catch-up coefficient and shifting the intercept.

22. DeLong suggests that measurement error may lead to false findings of convergence. However, Blomstrom, Lipsey and Zejan [1992] find that removing the countries with the least reliable Summers and Heston estimates of initial GDP (those never participating in an International Comparisons Project benchmark study) from their sample actually strengthens their findings of conditional convergence for their LDC sample, despite also using growth as calculated from Summers and Heston's GDP figures. Following Levine and Renelt [1992], we use World Bank growth data and the Summers-Heston initial income data. Studies using growth rates calculated from GDP estimates taken from the same source are more subject to measurement error, as underestimating initial GDP will automatically result in overestimating subsequent growth (or vice versa), unless final GDP is similarly underestimated.

23. Multicollinearity prevents multiple institutional indicators from attaining significance in the same equation in most specifications.

24. The coefficients and t-statistics reported for the interacted variables when standing alone describe their economic and statistical significance when evaluated at their respective means; the value of the interaction term is zero when either of the interacted variables equals its mean, facilitating calculations of variable impact and significance.

TABLE II

Rule of Law, Contract Enforceability and Convergence

Dependent variable: average real per capita growth in GDP, 1960–1989

Variables	Rule of Law		Contract Enforceability	
	(1)	(2)	(3)	(4)
Constant	−8.014	−8.982	−3.890	−2.934
	(2.291)	(2.360)	(3.961)	(3.976)
Primary Enrollment	3.205	3.028	3.255	1.716
	(0.725)	(0.710)	(1.226)	(1.217)
Secondary Enrollment	3.433	3.045	2.958	3.344
	(1.155)	(1.136)	(1.182)	(1.364)
Labor Force Growth	1.732	1.571	2.497	1.977
	(1.053)	(0.730)	(1.377)	(1.009)
Price Changes	1.263	1.160	0.101	−0.277
	(0.551)	(0.538)	(0.858)	(0.794)
Income Gap	1.101	1.329	1.223	1.487
	(0.333)	(0.350)	(0.496)	(0.455)
Institutional Variable		0.467		0.826
		(0.129)		(0.408)
Institution × Income Gap		0.266		1.119
		(0.123)		(0.430)
N	97	97	47	47
Adj. *R*-Square	0.295	0.406	0.256	0.398

Note: White-corrected standard errors are in parentheses. Institutional variables are rule of law (columns 1 and 2) and contract enforceability (columns 3 and 4).

both cases statistically and economically significant. Not only is growth faster when institutions are better, so also is convergence. In addition, the inclusion of the institutional and interaction terms raises the explanatory power of the regressions in each case. With contract enforceability, the adjusted R^2 rises from .26 to .4; in the case of the rule of law, it rises from .3 to .41. In models not reported in the table, we added the ratio of investment to GDP as an explanatory variable to the specification in models (2) and (4). Investment/GDP is significant in both regressions. The interaction and institutional variables remain highly significant even in the presence of investment, although their magnitude does drop somewhat (the rule of law interaction coefficient drops from .266 to .190, and the contract enforceability interaction drops from 1.12 to .87). This drop is expected, since institutions operate in part on the level of investment in a country, as well as on the efficiency with which inputs are combined.[25]

Table III summarizes the institutional results for the Business Risk and Country Risk indices, and executive constraints. Each of the three panels of Table III shows the coefficients and standard errors for the relevant institutional variable, the income gap, and the interaction between the two, from regressions corresponding to those reported in Table II. In addition, we report the institutional and income gap results from a model without the interaction term.[26] Results for the Country Risk and Business Risk indexes in Table III provide significant support for the hypothesis that the speed of convergence varies with the quality of institutions.

25. Similar results were found using the remaining individual Country Risk and Business Risk variables with two exceptions. Corruption, a Country Risk variable, is a significant direct determinant of growth, but it does not seem to affect the speed with which countries converge its interaction with the income gap variable is both economically and statistically insignificant. The interaction term that includes bureaucratic quality, another Country Risk variable, is more robust than corruption, but less significant than the other interaction terms we examine.

26. The top row in each panel corresponds to Models (2) and (4) in Table II; the bottom row corresponds to Models (1) and (3). The middle row is equivalent to Models (1) and (3) with the addition only of the institutional variable, without the interaction term.

TABLE III

Country Risk and Business Risk Indexes and Executive Constraints

Dependent Variable: Average growth of per capita income, 1960–1989

Institutional Variable	Institutions × Income Gap	Institutional Variable	Income Gap	Adj. R-Sq	N
Country Risk Index	0.043 (0.017)	0.085 (0.021)	1.410 (0.321)	0.449	97
w/o interaction		0.075 (0.021)	1.529 (0.275)	0.419	97
w/o institutions or interaction			1.101 (0.333)	0.295	97
Business Risk Index	0.397 (0.146)	0.332 (0.126)	1.429 (0.410)	0.437	47
w/o interaction		0.271 (0.090)	1.525 (0.489)	0.300	47
w/o institutions or interaction			1.223 (0.496)	0.256	47
Executive Constraints	0.195 (0.107)	0.157 (0.123)	1.047 (0.289)	0.373	102
w/o interaction		0.157 (0.133)	1.139 (0.319)	0.350	102
w/o institutions or interaction			1.005 (0.294)	0.337	102

Notes: White-corrected standard errors are in parentheses. Other independent variables include primary and secondary enrollments in 1960, labor force growth and price changes.

The hypothesis that constraints on the executive branch strengthen property rights and therefore hasten growth and convergence finds modest support in the table. This result is in fact encouraging. With the executive constraints variable, we were only able to test the effects of one particular institutional structure for protecting property rights. The executive constraints variable does not take into account constraints imposed on the executive branch by powerful and well-trained bureaucracies, for example, as in East Asian countries. These same countries tend not to score well on the executive constraints variable, which suggests that the omitted institutional variables would bias the empirical results towards a rejection of the hypothesis. In this light, the results are somewhat more remarkable.

The Economic Significance of the Results

Table IV displays the impact on growth of a one-unit change in the income gap, when institutions are of varying quality.[27] Recalling that the income gap is the log of the ratio of U.S. income in 1960 to the income of the observed country in 1960, a one-unit increase in the income gap occurs when the following countries are compared (an increase in the gap implies a larger difference in 1960 GDP per capita between the richest and observed countries):

Chad (income per capita in 1960 = $667, gap = 2.68) to Ethiopia (income per capita in 1960 = $247, gap = 3.67);

South Africa (income per capita in 1960 = $2109, gap = 1.53) to Egypt (income per capita in 1960 = $770, gap = 2.54);

27. Because corruption and bureaucratic quality are notably less significant than the other Business Risk and Country Risk variables, all of the variables, including the components of the Business Risk and Country Risk indices, are reported separately.

TABLE IV

Impact of a One-Unit Increase in the Income Gap on Yearly Rates of Growth

	Business Risk (0–16)		Country Risk (0–50)		Executive Constraints (1–7)	
Worst Institutions	–0.91	[1.2]	0.55	[8]	0.47	[1]
Mean Institutions	1.43	[7.08]	1.41	[27.9]	1.05	[3.95]
Best Institutions	2.95	[10.9]	2.36	[50]	1.64	[7]

Note: Figures indicate how much faster growth would be, in percentage points, for a one-unit increase in the income gap, if institutions were of the specified quality. Numbers in brackets represent the worst, mean and best values in the sample of the respective institutional variables.

Norway (income per capita in 1960 = $5665, gap = .55) to Suriname (income per capita in 1960 = $2097, gap = 1.54).

The numbers in brackets in Table IV are the worst, mean and best values of the particular institutional variable in the sample. The first number in each cell indicates how much faster yearly growth would be with a one-unit increase in the income gap, such as those cited in the previous paragraph, given the quality of the country's institutions. The Business Risk Index provides the most dramatic indication of the importance of institutions: when institutions are poor, we observe divergence rather than convergence. When the Business Risk Index equals 1.2, a one-unit increase in the income gap is associated with subsequent growth that is .91 percentage points slower per year. On the other hand, for countries with the highest Business Risk Index score (10.9 in the sample), a one-unit increase in the income gap is associated with subsequent growth that is 2.95 percentage points faster.

The other institutional variables do not support the notion that there is actual divergence when institutions are poor, but they provide ample evidence that the ability of countries to take advantage of "relative backwardness" depends significantly on their institutions. Countries that constrain their executives grow three and a half times faster in response to a one-unit increase in the gap than countries that do not, and countries that score best on the Country Risk Index grow more than four times faster.

V. ROBUSTNESS OF THE RESULTS

There are three robustness issues that we consider. The first is whether the results above are the product of reverse causality—countries that grow rapidly, thereby becoming more developed, subsequently spend more resources to protect property rights.[28] We provide evidence suggesting that this is not the case. Second, we amply document the robustness of the findings across different samples. Third, we demonstrate that the results are robust to specification changes such as the introduction of policy variables.

Economic growth may have some effect on incentives to create institutions that protect property rights. For example, investments to protect property rights are not made unless the expected value of the rights is sufficient to outweigh the costs of protection. Economic growth raises the value of property rights. However, nearly all countries have assets that are sufficiently valuable, even without further economic growth, to justify significant investments in the security of rights to them. Moreover, it is common to find that countries do not undertake efforts to improve the institutional environment even after a large endowment of natural resources is uncovered. In many cases, such as Zaire (Congo), the reverse is true.[29]

We find no empirical support, in four different tests, for the claim that the results found here arise solely because economic growth produces good institutions. First, if causality operated only from growth to institutions then regressions employing end-of-period values of the institutional indicators should pro

28. Helliwell [1994] finds that Gastil's civil liberties and political freedoms indices follow, rather than lead changes in GDP.

29. See Clague, Keefer, Knack and Olson [1996] for a broader discussion of these issues.

duce larger coefficients than regressions relying upon older data. This is not the case. When 1992 values of the Country Risk Index are substituted for the 1982 values, the resulting coefficients are very similar. Second, the findings reported here for the sample period 1960–1989 have been replicated for the shorter 1974–1989 period for the 1972 Business Risk data, despite the greater potential for random shocks to undermine results for this shorter period.[30] Third, the interaction terms using Business Risk data from 1972 are stronger than those employing Country Risk indicators from 1982 for the sample period 1960–1989. We would expect the opposite if the dominant direction of causality was from growth to secure property rights. Fourth, the executive constraints variable is in any case not from the end of the period, but an average over the period, making reverse causality from growth to this indicator particularly unlikely.

The hypothesis that growth improves institutions must also contend with some anomalies. South Korea's Business Risk Index score was 7.0 in 1972 and 6.6 in 1989. Malaysia's Business Risk scores were 7.3 and 6.6. If the causal relationship between growth and institutions primarily ran from the former to the latter, one would have expected institutional scores for these two rapid growers to have been markedly higher in 1989.

The second robustness issue is whether the results are sensitive to changes in the sample. The Country Risk and Executive Constraints samples each have over 95 countries and are approximately the same as the sample used by Barro [1991]. The Business Risk sample contains 46 countries. All three samples yield significant results. Moreover, the interaction terms are significant when each of the institutional variables is used in regressions with the samples represented by the other two variables: the Country Risk Index and associated interaction term are significant in all three samples, as are the Business Risk Index and interaction term. Executive constraints and its interaction with the income gap are significant in all but the Business Risk sample, where the magnitude of the coefficient on the interaction term actually rises relative to the Executive Constraints sample.

Another possible sample selection issue is that developed countries, which grow faster on average than developing countries, have higher institutional scores than the developing countries. This difference may drive the results, even when institutions have no effect on either group of countries taken alone. However, we find that the variables are also significant when OECD countries and the Four Tigers (Hong Kong, Korea, Singapore, and Taiwan) are omitted. The interaction terms that include the Business Risk Index and executive constraints remain significant when OECD countries are removed, and the Country Risk Index is nearly significant. With the Four Tigers also omitted, the interaction term with executive constraints remains significant, and the Country Risk Index interaction becomes more significant, although the Business Risk Index interaction loses significance.

These results are sustained when we look at a group of countries that were rich at the beginning of the period. DeLong [1988] suggests that an appropriate test of whether poorer countries grow more rapidly than wealthy countries would avoid using a sample of countries chosen because they are developed ex post, creating a bias towards finding convergence. We use a sample of the 24 richest non-oil countries (an OECD-sized sample) in 1960 (DeLong went back to 1880). The poorest of these countries was Chile, with a per capita income in 1960 of $2,893. We find that the interaction term remains highly significant using the Country Risk Index, and modestly significant for executive constraints.[31] In both cases, the economic magnitude of the interaction terms is large.

The third robustness issue relates to specification. Levine and Renelt [1992] apply a technique developed by Leamer [1983], extreme-bounds analysis, to examine the sensitivity of variables of interest to alternative specifications. Following this, we looked at the sensitivity of our results to the inclusion of different subsets of seven variables. It might be argued that institutional variables are

30. Of course, these simple tests do not reject the presence of endogeneity altogether. They do cast doubt on the importance of the objection, however.

31. The overlap of this group of countries with the Business Risk sample is too small for this exercise to be repeated with the Business Risk Index.

significant because insecure property rights happen to coincide with distortionary economic policies, which are the actual obstacles to growth. To control for this possibility, five of the variables used in the extreme-bounds analysis are the growth and level of government consumption, the growth of exports, average trade intensity over the period and the black market premium. Two other political variables used by Levine and Renelt, coups and revolutions (the variable used by Barro as a proxy for political stability), and political freedoms and civil liberties (from Gastil), were also included. The Country Risk Index was used as the institutional variable.

More than twenty different specifications were run with and without the interaction term, using different groups of three of the conditioning variables. The Country Risk Index term was significant in all regressions that did not include the interaction term (*Country Risk Index* × *Income Gap*). The interaction term remained significant in all specifications except for some of those that contain the export growth variable as one of the three conditioning variables.

A second specification issue arises in response to the possibility that convergence is simply a phenomenon of "regression to the mean." The argument is that, at any point in time, poor countries are more likely to have been subject to negative stochastic income shocks and rich countries to positive stochastic income shocks. Subsequent to these shocks, the poor countries should be observed to grow faster, and the rich countries more slowly, as they "regress to their mean" rates of growth. If this is a serious issue in cross-country growth regressions, then convergence results should weaken if one uses mid-period (1975) rather than initial year (1960) GDP to operationalize "relative backwardness."[32] Results on the Country Risk and Business Risk measures, the income gap, and the interaction between institutions and the gap prove insensitive to this substitution, however.

32. See Friedman's [1992] discussion of "regression toward the mean" in the context of cross-national income convergence. DeLong and Summers [1991] use mid-period GDP as an alternative catch-up specification.

VI. CONCLUSION

The evidence presented here suggests that institutions are powerful determinants of the ability of countries to benefit from the "catch-up" effect. While poorer countries may have advantages because of low-cost access to advanced technology or the diminishing returns experienced by wealthier countries, these potential advantages appear to be squandered in countries with poor institutional frameworks.

There are other explanations for the breakdown of technological diffusion between countries. Most of these, however, are likely to be also symptomatic of institutions that insufficiently protect property and contractual rights. This is true of low levels of investment, for example. To the extent that they are fixed or specialized, human capital, machinery and foreign investments are likely to be lower in countries where property and contractual rights are at risk. Human capital acquisition, machinery and foreign investments, and foreign trade are all suggested as vehicles for the international transmission and absorption of technology. Insufficient levels of any of these, however, may have as one explanation poor institutions. To the extent that this is the case, breakdowns in foreign investment or human capital accumulation should be considered proximate, but not fundamental causes of low growth rates and the failure to catch up.

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